AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claims 1-7 (canceled).

Claim 8 (new): A mechanical quantity sensor comprising:

two piezoelectric vibrators arranged to receive stresses caused by a mechanical quantity in opposite directions;

a voltage signal applying circuit arranged to apply a voltage signal to the two piezoelectric vibrators;

a current-to-voltage converter circuit arranged to convert electric current signals flowing through the piezoelectric vibrators into voltage signals;

a phase difference signal processing circuit arranged to detect a phase difference between the voltage signals output from the current-to-voltage converter circuit and output a mechanical quantity detection signal; and

resistors arranged in electric current paths of the two piezoelectric vibrators; wherein

the voltage signal applying circuit includes:

a voltage amplifier and amplitude limiter circuit arranged to amplify the voltage of an added signal corresponding to an added value of currents flowing through the two piezoelectric vibrators and to limit the amplitude of the voltage signal output from the voltage amplifier circuit to a predetermined value;

a phase control circuit arranged to detect the phase difference between a feedback voltage signal applied to both of the two piezoelectric vibrators and the added signal and control the phase of the feedback voltage signal so that the phase difference equals a predetermined value; and

a filter circuit arranged to minimize unwanted frequency components of the feedback voltage signal; and

wherein the mechanical quantity sensor is oscillated by the piezoelectric vibrators, the voltage amplifier circuit, the amplitude limiter circuit, the phase control circuit, and the filter circuit.

Claim 9 (new): The mechanical quantity sensor according to Claim 8, wherein the filter circuit is a low-pass filter having a passing band including the oscillation frequency.

Claim 10 (new): The mechanical quantity sensor according to Claim 8, wherein the phase control circuit includes:

a phase-difference-to-voltage converter circuit arranged to convert the phase difference between the added signal and the feedback voltage signal into a voltage signal;

a comparator circuit arranged to compare an output signal from the phase-difference-to-voltage converter circuit and a reference signal; and

an all-pass filter including a voltage controlled resistance circuit whose impedance is changed in accordance with an output voltage from the comparator circuit, wherein the phase of the all-pass filter is changed in accordance with the impedance of the voltage controlled resistance circuit.

Claim 11 (new): The mechanical quantity sensor according to Claim 8, wherein the phase control circuit is arranged to control the phase difference between the feedback voltage signal and the added signal so that detection sensitivity of the mechanical quantity is maximized.

Claim 12 (new): The mechanical quantity sensor according to Claim 8, wherein the mechanical quantity is acceleration.

Claim 13 (new): The mechanical quantity sensor according to Claim 8, wherein the mechanical quantity is angular acceleration.

Claim 14 (new): The mechanical quantity sensor according to Claim 8, wherein the mechanical quantity is angular velocity.

Claim 15 (new): The mechanical quantity sensor according to Claim 8, wherein the mechanical quantity is a load.

Claim 16 (new): A mechanical quantity sensor comprising:

two piezoelectric vibrators arranged to receive stresses caused by a mechanical quantity in opposite directions;

a circuit arranged to apply a voltage signal to both of the two piezoelectric vibrators, wherein the circuit includes:

a voltage amplifier/amplitude limiter circuit arranged to amplify the voltage of an added signal corresponding to an added value of currents flowing through the two piezoelectric vibrators and to limit the amplitude of the voltage signal output from the voltage amplifier circuit to a predetermined value; and

a phase control circuit arranged to detect the phase difference between a feedback voltage signal applied to both the piezoelectric vibrators and the added signal and control the phase of the feedback voltage signal so that the phase difference equals a predetermined value;

a circuit arranged to convert electric current signals flowing through the piezoelectric vibrators into voltage signals; and

a circuit arranged to detect a phase difference between the voltage signals output from the converter circuit and output a mechanical quantity detection signal.

Claim 17 (new): The mechanical quantity sensor according to Claim 16, wherein the circuit arranged to apply a voltage signal to both of the piezoelectric vibrators further includes a filter circuit configured to minimize unwanted frequency components of the feedback voltage signal.

Claim 18 (new): The mechanical quantity sensor according to Claim 17, wherein the filter circuit is a low-pass filter having a passing band including the oscillation frequency.

Claim 19 (new): The mechanical quantity sensor according to Claim 16, wherein the phase control circuit includes a phase-difference-to-voltage converter circuit arranged to convert the phase difference between the added signal and the feedback voltage signal into a voltage signal.

Claim 20 (new): The mechanical quantity sensor according to Claim 19, wherein the phase control circuit includes a comparator circuit arranged to compare an output signal from the phase-difference-to-voltage converter circuit and a reference signal.

Claim 21 (new): The mechanical quantity sensor according to Claim 20, wherein the phase control circuit includes an all-pass filter including a voltage controlled resistance circuit whose impedance is changed in accordance with an output voltage from the comparator circuit, wherein the phase of the all-pass filter is changed in accordance with the impedance of the voltage controlled resistance circuit.

Claim 22 (new): The mechanical quantity sensor according to Claim 16, wherein the mechanical quantity is one of acceleration, angular acceleration, angular velocity, and a load.

Claim 23 (new): The mechanical quantity sensor according to Claim 16, further comprising resistors connected in series to the two piezoelectric vibrators.

Claim 24 (new): The mechanical quantity sensor according to Claim 16, further comprising resistors connected between inputs of operational amplifiers in the converter circuit and ground.